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A redevelopment of the Research Ambient Noise Directionality (RANDI-II) model[1] has been performed using a parabolic equation (PE) model for the prop loss component of the model. The model (RANDI-PE) calculates noise due to shipping and wind in range dependent and azimuthally varying environments. Several nonacoustic effects on the noise and noise directionality have been included. Complex pressures are computed at each hydrophone location for an arbitrary system system. Conventional beamforming algorithms exist within the model of phone outputs can be fed into more sophisticated signal processing systems. Examples will be given for horizontal, vertical, tilted and three-dimensional arrays.

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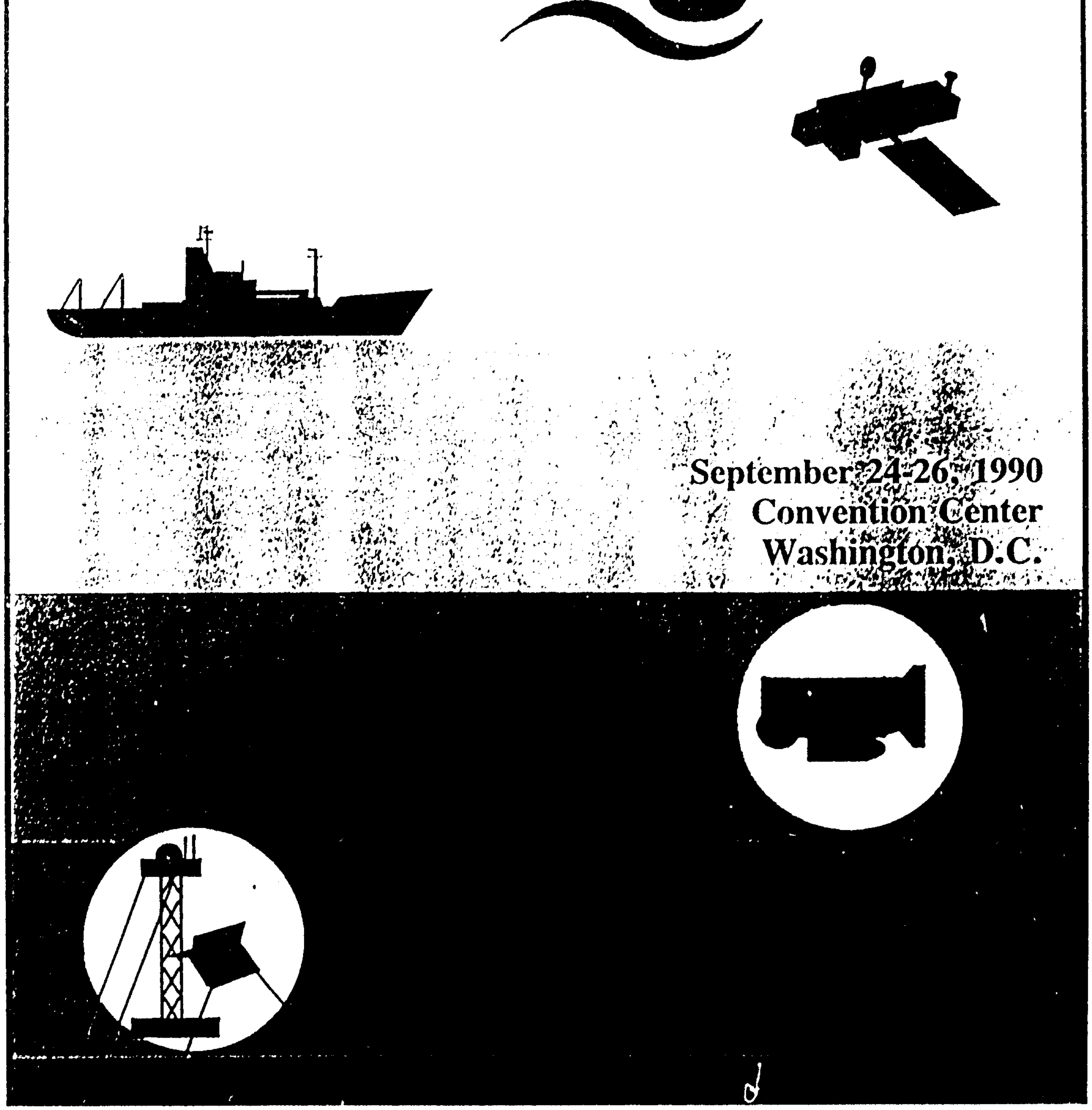

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THE RANDI-PE NOISE MODEL

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ABSTRACT

A redevelopment of the Research Ambient Noise Directionality (RANDI-II) model[1] has been performed using a parabolic equation (PE) model for the prop loss component of the model. The model (RANDI-PE) calculates noise due to shipping and wind in range dependent and azimuthally varying environments. Several nonacoustic effects on the noise and noise directionality have been included. Complex pressures are computed at each hydrophone location for an arbitrary system. Conventional beamforming algorithms exist within the model or phone outputs can be fed into more sophisticated signal processing systems. Examples will be given for horizontal, vertical, tilted and three-dimensional arrays.

INTRODUCTION

The Research Ambient Noise Directionality model (RANDI-II)[1] was developed to simulate the response of an acoustic system in the presence of ambient noise in the ocean. The model generates noise at specified hydrophone locations in a range dependent and azimuthally varying environment due to both shipping and wind. RANDI-II contains an adiabatic mode calculation, (SuperSNAP)[2] which only allows for a very mild range dependence. A more robust calculation, one that would allow input of highly complex environments, can be achieved with one of the high angle parabolic equation (PE) models.[3,4]

The RANDI-II model was redesigned to accommodate both a high angle PE, (FEPE) and a faster deep water split-step PE.[5] The model, (RANDI-PE) provides many important performance enhancements. First of all, RANDI-PE can calculate, with a reasonable degree of accuracy, acoustic pressure over several hundred variations in environment, whether bathymetry, sound speed or sediment type. RANDI-II can at most handle only ten to fifteen changes in a given azimuth with a poorer technique for handling range variations in the environment.

RANDI-PE can produce a fine scale complex pressure field varying in range, depth and azimuth about a given location. This facilitates the performance testing of systems with an arbitrary number of sensors at arbitrary locations within the area without recomputing the pressure field.

In addition, RANDI-PE is a more compact, less fragmented program which is easier to operate and does not overload disk space with large mode data files.

MODEL FEATURES

If environmental information for an area of interest is available it can be read into RANDI-PE for processing. Otherwise, the model will extract from Navy standard data bases bathymetry, sound speed profiles and sediment parameters as well as shipping distributions. There are several output options available depending on the desired application. The complex pressure is computed and/or stored at specified depth and range increments in the ratios of the largest potential system to be modeled. Optionally, at this point the pressures can be calculated at specific element locations for a particular system. Also, the model will compute the pressure over changing environments throughout the region of the array. This is ideal for examining bottom mounted ... near bottom systems.

Phone responses are output for ex... processing and/or some processing algo... have been installed to obtain conventional... and sum or FFT beamformed outputs. Fo... arrays several headings can be processed... time. Nonacoustic effects on beamforming... as array tilt, dead phones and flow noise ca... be simulated by the model.

SUMMARY

When the environment is compl... strongly range and/or azimuthally ... RANDI-PE is a unique and powerful ... probing underwater noise characteristics, ... system performance, signal processing ...

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in the presence of a complex noise field, etc. For situations where there is only mild range dependence, RANDI-II has proven to be a reliable resource. Although RANDI-PE could be competitive in these environments as well because of today's emerging technology, computer systems using high performance array processors have proven to be extremely powerful on FFT calculations.

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